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THE RELATIONSHIP OF LEARNER CHARACTERISTICS TO MEDIA STIMULI AND PROGRAMING SEQUENCES.

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THREE EXPERIMENTS WERE CONDUCTED ON THE USE OF PROGRAMED INSTRUCTION TO TEACH GENERAL SCIENCE TO EIGHTH GRADE STUDENTS. THREE VISUAL STIMULUS MODES AND THREE AUDIO STIMULUS MODES WERE USED WITH EITHER LINEAR OR BRANCHING PROGRAMS AND SUBJECT CONTENT WHICH WAS EITHER NON-CONCRETE, CONCRETE, OR ACTION-PROCESS. LEARNER CHARACTERISTICS VARIED WERE IQ, SEX, ACHIEVEMENT, ETHNIC BACKGROUND, PARENT'S OCCUPATIONS, AND APTITUDE. AUTOMATED TEACHING DEVICES WERE USED WHICH INCORPORATED BOTH FILM STRIPS AND SLIDE PROJECTORS. DATA COLLECTED ON AMOUNT LEARNED WERE ANALYZED USING ANALYSIS OF VARIANCE, FACTOR ANALYSIS, MULTIPLE REGRESSION, AND COVARIANCE ANALYSIS. IQ SCORE WAS THE BEST PREDICTOR OF LEARNING. ETHNIC BACKGROUND ACCOUNTED FOR ONLY A SMALL PORTION OF THE TOTAL VARIANCE. A POSITIVE CORRELATION BETWEEN LEARNING AND PARENT'S OCCUPATION WAS SIGNIFICANT FOR ALL THREE EXPERIMENTS. NO SEX DIFFERENCES, INDEPENDENT OF OCCUPATIONAL AND ETHNIC BACKGROUND DIFFERENCES, WERE FOUND. EXCEPTIONAL CHILDREN (I.E., LOW IQ, AND NON-WHITE, AND REPRESENTING THE THREE LOWEST OCCUPATIONAL GROUPS) LEARNED BEST WITH THE BRANCHING, NONVERBAL, SOUND TREATMENTS USED IN PRESENTING THE MATERIAL. SOME INDICATIONS WERE FOUND THAT THE EXCEPTIONAL CHILDREN LEARNED BETTER WITH THE BRANCHING THAN WITH THE LINEAR PROGRAMS. (RG)

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ABSTRACT

The purpose of this study was twofold: (1) to examine the relationship of learner characteristics of IQ, achievement, sex, ethnic classification, parent's occupational grouping and audiovisual stimuli presented in linear and branching sequences; and (2) to develop and explore the value of a specially designed test battery comprised principally of divergent and convergent figural items for predicting learner performance. Any identification of particular student characteristics related to specific presentation configurations might suggest a means for more effective instructional communication.

The experimental population consisted of 1,222 eighth grade students drawn from four junior high schools in the Los Angeles City School District.

The findings were as follows:

1. The learner characteristics did interact with media and programing modes to affect scores on the dependent variable. Total IQ score provided the highest correlation with the dependent variable.

2. Ethnic classification had a significant interaction with the criterion measure but accounted for only a small portion of the variance affecting the posttest score.

3. The occupation of a student's parent did bear a direct relationship to the posttest scores. Higher scores were significantly related to higher occupational classifications.

4. The sex variable did not contribute to prognostic accuracy when considered individually.

5. The percent of variation within the ethnic classifications of White and Non-white was greater than the variation between the groups on the criterion measure, total IQ, and F Battery scores.

6. Three figural subtests of the F Battery, identical forms, figural similarities, and match problems, tended to minimize the variation between ethnic classifications and may be identified as potentially "low anxiety" items for Non-white learners.

7. Some indications were obtained that exceptional children, identified as having low IQ, Non-white, and representing the three lowest occupational groups, obtain higher scores after receiving the non-verbal, sound, branching treatments.

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1.0 INTRODUCTION

There is an essential need in our culture for more efficient communication and specifically for more effective instructional communication. The "information explosion" compounds the task and creates a crisis which is intensified daily by a critical and immediate need for the use of new knowledge.

Today educational media such as films, filmstrips, television, teaching machines, and recordings provide instruction that differs from that traditionally furnished by the textbook. Total effective utilization of these non-textbook media is complicated by the lack of sufficient precise knowledge as to which of the media is most successful with learners having dissimilar characteristics.

Important educational benefits could accrue if learner characteristics such as IQ, achievement, ethnic classification, parental occupation grouping, and sex were related to responses produced and learning gains provided by different media. Programs being conducted for the culturally deprived, school dropouts, and manpower retraining candidates might all be aided.

If it is true, for instance, that learning patterns of culturally deprived youngsters are a reflection of selective retardation in their intellectual development, then some determination must be made whether one medium or a specifically deduced combination of media, may effectively overcome these elements of retardation. By no means is selective retardation confined to culturally deprived children; it is discernible in varying degrees in all learners. Unless additional clues are provided to guide media utilization based on specific learner characteristics, large sums of money, manpower, and time will be wasted employing non-textbook media in a haphazard and meaningless fashion.

Indications of the predominant learning style in a particular youngster may be detected by prior measures of intelligence and achievement and possibly in factors related to his socioeconomic background. A learner's basic style of learning is probably determined early in life, and although subject to change the best and most permanent learning is likely to come mainly from the utilization of this one predominant style. Any attempt to overcome reading weaknesses, as an example, could benefit from the identification of a learner's relative strength in listening or perhaps learning from visuals and then providing remedial instruction employing the suitable media. As suggested by Semler and Iscoe (1966) it is probable that changes in economic conditions, early intervention with innovative educational procedures, and increased opportunity to learn will produce a different yield from cross-cultural studies of intelligence than had been reported previously. It is toward an identification of the effort of the interaction of innovative educational media with cultural factors that this study is directed.

1.1 Purpose of the Study

The purpose of this study was twofold: (1) to examine the extent of interaction between learners' IQ, achievement, sex, ethnic group, parents' occupation, and audiovisual stimuli presented in linear and branching programed sequences; and (2) to explore the value of a test battery, comprised primarily of non-verbal items of divergent and convergent figural production abilities, and designated the F Battery, for predicting performance of learners who are taught by different stimuli and programing sequences. These items were related to batteries used to measure similar abilities (e.g., Guilford, Merrifield (1960); and Merrifield, Guilford, and Gershon (1963)).

2.0 METHODS

2.1 Subjects

The total experimental population consisted of 1400 eighth grade students drawn from four junior high schools in the Los Angeles City School System. The City of Los Angeles Unified School District covers 710.6 square miles, includes slightly less than 3 million people and has an eighth grade junior high school population of approximately 42,000 students. A distinct advantage in determining comparable variables in background was the similar administrative procedures, standardized student records, and uniform curriculum requirements present in this system's schools.

It was recognized that no one section of metropolitan Los Angeles could be considered typical. Yet it was believed that by selecting one school in each of four geographical sections of the city, elements of a wide range of occupational and ethnic groups present in the area's population could be attained. The schools themselves were carefully chosen to include students who, on standardized intelligence and achievement measures, recorded scores in the entire range of abilities.

2.2 Basic Design

This study investigated the effectiveness of three visual stimulus modes (verbal, graphic, and motion) and three audio stimulus modes (redundant, directive, and no sound) presented in machine-mediated programed instruction. Each stimulus mode was studied in relation to programing technique (linear or branching) and to learner characteristics of IQ, achievement, age, sex, a specially-constructed aptitude measure, ethnic classification, and parents' occupational grouping.

Three parallel experiments were conducted using subject content designated as Non-Concrete, Concrete, and Action-Process. Programed instruction sequences requiring constructed and multiple-choice responses were presented using automated teaching devices that incorporated 16 mm. motion picture film and slide projectors.

The three separate experiments combined three visual presentation modes with each of three audio implementation modes and each of the programing techniques comprising a 3 x 3 x 2 factorial design. The flexibility of the teaching devices permitted testing of hypotheses about ways to present information for optimum learning and exploration of how learner characteristics related to 18 different presentation combinations.[1]

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[1] The learner characteristic investigation was part of a larger study "Visual and Audio Stimuli in Machine Programed Instruction," conducted under U.S. Office of Education Cooperative Research Project No. 1956. Dr. William H. Allen was Principal Investigator and the author was Associate Investigator.

2.3 Procedures

There were several reasons why the Los Angeles City Unified School System was picked as the locale for this study. First of all, it met all the criteria listed above and also provided convenient geographic access. In addition, students in the Los Angeles City Schools are required to complete the California Test of Mental Maturity, and the California Achievement Tests for measuring their reading, arithmetic, English, and spelling levels both in Grade 5 and in Grade 8. Consequently, the participating students in all four schools had both intelligence and achievement test scores obtained at the same time and administered in a uniform manner.

It was also important to find a close approximation of science curriculums in all subject schools. This criteria was fulfilled in the Los Angeles system, thereby making it possible to closely estimate prior knowledge and content being taught during the experiment in the field of general science; the broad content area selected for presentation in the stimulus materials.

Students were selected at random from within the system primarily on the basis of their class attendance, however, students designated as below 80 IQ on all evaluation data, (sub-scores of CTMM and CAT) and those assigned to mentally retarded groupings, were not involved. Since the subjects were to be assigned randomly to the teaching machine treatments, it was believed that additional selection procedures were not required. Eventually, experimental data of 1232 students was acceptable for use in all three experiments. IQ scores recorded on the CTMM ranged from 69 to 155 for the total population. The mean IQ score was 101.95. Of this number 388 participated in the first experiment, Non-Concrete Referent; 411 in the second experiment, Concrete Referent; and 433 were involved in the third experiment, Action-Process. Of this number 639 were girls (51.87%) and 593 were boys (48.13%).

The method used for assigning students to the experimental treatments involved using a table of random numbers. Following the assignment of a unique number to each student, these numbers were then assigned randomly to 18 groups for each experiment. If the student population from one school was to be divided and assigned to two experiments the same procedure was followed, however, when the total number desired for one experiment was obtained, the other numbers were then assigned randomly to the 18 groups in the second experiment. A pool of 36 students was provided for each experiment to provide substitutes for absentees.

2.4 Environment

Requirements for research control of viewing and testing facilities were met in two ways. It was clearly impractical to transport the students from all four schools to a central point. What was necessary was to devise a fixed yet mobile environment where students could operate the teaching machines and

view the stimulus materials. This was accomplished by taking a fifty-five foot air conditioned teaching trailer equpped with teaching machines to each of the school locations. The trailer contained six student teaching stations, each having a viewing screen, response buttons, and a desk area containing a paper roll for writing constructed responses. A waiting room for the subjects and a section containing the experimental equipment, which was unobserved by the subjects, comprised the remainder of the interior of the trailer.

2.5 Developmental Test Population

Four separate groups of students were involved as test subjects in the development of the programed materials. Junior High School (A) provided eighth graders who helped with the development of the Non-Concrete Referent materials a year before the experimental data were collected. Students who had completed the first half of the eighth grade and would not be eligible as subjects for the experiments, assisted with the development of the Concrete Referent, and Action-Process programs.

The Culver City Junior High School, external to the Los Angeles City School District, provided six eighth grade students during the summer session of 1963, to act as subjects for program development of the Non-Concrete Referent Materials. These students were in summer school for remedial work and provided a marked contrast in ability to the students from Junior High School (A).

Fourteen students from the Foshay Junior High School in the Los Angeles City system were used for establishing the reliability of the Non-Concrete Referent Programed Materials on the teaching machines. Twenty Foshay students also served as subjects for the development of the Concrete Referent Materials. The students in the developmental population paralleled the ability range and ethnic and occupational diversity represented in the experimental population.

A pilot run was conducted involving eighty junior high school students in the Pasadena School System to standardize procedures for administering the experiment.

2.6 Statistical Techniques and Computer Programs

Four main types of analyses were performed in this study: correlation, variance, multiple-comparisons, and factor analyses. The basic formulation of the statistical techniques used is described in Snedecor (1956), Anderson (1958), Scheffe (1959), and Brownlee (1960).

A program prepared by Villone, McCornack, and Wood (1962) was used for the multiple regression with subsetting of variables. The general linear hypothesis program, BIMD 14, available in the Division of Biostatistics (UCLA) Program Catalogue (1960) was used to perform the analysis of variance and covariance. BIMD 03M was used to perform the factor analyses.

In conjunction with each analysis of variance, Bartlett's Test for Homogeneity of Variances and Welch's Test for Homogeneity of Means were performed as described in Snedecor (1956).

3.0 RESULTS

3.1 Total IQ Score

A high correlation of the total IQ score with the posttest score was recorded for all three experiments (.63, .66, .68). The total IQ score was identified as a principal covariate in the factor analysis. Further explorations of the role of the learner characteristic of total IQ were made through the use of a multiple regression analysis.

Examination of which combination of two, ten, and thirty-five variables could be used to predict total posttest scores was attempted. The following results were obtained, as reflected in Table 1.

1. In Experiment I and III the total IQ in combination with one other variable, the total F Battery score, provided a multiple correlation that was not significantly different from the correlation for the combination of the 10 major variables, or the ten variables plus 35 interactions.

2. In Experiment II the total IQ score, combined with one additional variable, the verbal-non verbal comparison, to produce a correlation that did differ from the 10 and 35 variable comparisons ($p < .01$)

3.2 Other Learner Characteristics

The relationship of the other learner characteristics to the dependent variable, the total IQ score, and each other is reflected in Table 2. Total IQ score when related to parent occupational grouping reveals a positive relationship that ranges from .306 to .394. The higher the occupational classification of the student, the higher total posttest score that was recorded for him. It must be recalled that the professional occupation class was recorded as 1 on the scale; managerial, 2; clerical, 3; skilled, 4; semi skilled, 5; and unskilled, 6.

When the relationship of ethnic classification to total IQ score is examined, the relationship is positive in the first two experiments (.431 and .461) but not as great on the third experiment (.250). These correlations must be interpreted keeping in mind the numbers assigned to each ethnic classification, i.e., Negro, 1; Oriental-American, 2; Mexican-American, 3; Caucasian, 4. Consequently, a higher correlation with IQ would favor a direct relation between high IQ score and "whiteness."

The relationship of IQ total score to sex is reflected in the correlations for all three experiments (.090, -.059, and -.031). The negative correlations indicate some advantage for the males in regard to total IQ score, but

TABLE 1

INDEPENDENT VARIABLES AND POSTTEST RELATIONSHIPS
MULTIPLE REGRESSION ANALYSIS

Number of Variables	Multiple Correlation Coefficients								
	Experiment I (N=388)			Experiment II (N=411)			Experiment III (N=433)		
	R^2	F	df	R^2	F	df	R^2	F	df
2:									
IQ and F Bat (I) IQ and Verbal (II) IQ and F Bat (III)	.645			.692			.700		
		1.06	(8, 372)		6.74[a]	(8, 366)		1.81	(8, 373)
10: F Battery Total IQ Total Occupation Ethnic Sex Programing Modes Visual Modes Sound Modes	.655			.739			.711		
2:	.645			.692			.700		
		1.11	(33, 347)		2.56[a]	(23, 351)		1.23	(33, 348)
25 interactions and 10 above	.676			.744			.737		

TABLE 2

CORRELATIONS OF SELECTED LEARNER CHARACTERISTICS WITH THE DEPENDENT VARIABLE AND EACH OTHER

Experiment I	Occupation	Ethnic	Sex	Post-Test	IQ	F Battery
Occupation		-385[a]	-050	-377[a]	-359[a]	-285[a]
Ethnic			-040	340[a]	431[a]	376[a]
Sex				-050	090	021
Posttest					662[a]	543[a]
IQ						642[a]
F Battery						---

Experiment II	Occupation	Ethnic	Sex	Post-Test	IQ	F Battery
Occupation		-607[a]	-015[a]	-244[a]	-394[a]	240[a]
Ethnic			-002	268[a]	461[a]	287[a]
Sex				-025	-059	134[a]
Posttest					626[a]	474[a]
IQ						546[a]
F Battery						---

Experiment III	Occupation	Ethnic	Sex	Post-Test	IQ	F Battery
Occupation		-272[a]	-036	-273[a]	-306[a]	-173[a]
Ethnic			021	268[a]	250[a]	159[a]
Sex				-007	-031	079
Posttest					680[a]	532[a]
IQ						587[a]
F Battery						---

[a] $(p < .01)$

this difference was minor.

The association of the total IQ score and the total F Battery score was mentioned in conjunction with the review of the correlation tables. Another finding that reflects the strength of this relationship (.642, .546, and .587) are the data reported in the learner characteristic grouping.

3.2.1 Ethnic

Difficulties were encountered when an examination of ethnic differences for all 18 treatments in any one experiment was attempted. In many instances a particular visual-sound-programing treatment had not been viewed by any sizeable number of Oriental-American or Mexican-American students. In order to facilitate comparisons of ethnic groups between and across experimental treatments some grouping of categories was required. The pattern of posttest performances seemed to indicate that the means and standard deviations for the Negro and Mexican-American students were similar enough to justify placing their data in a designated "Non-white" category. The posttest scores for the Oriental-American students generally paralleled those recorded for the Caucasian students. A decision was then made to extract the Oriental student from the analysis in order to provide a sharper contrast, thus creating a group to include the Caucasian students designated White, and also to avoid further exaggerating the imbalance in number between the White-Nonwhite groups. This decision reduced the sample size in Experiment I by 1.3 percent; in Experiment II, 8.4 percent; and in Experiment III, 11.3 percent.

The correlations provided in Table 3 reflect the results of a multiple regression analysis designed to assess the ethnic and stimuli-programing mode interaction based on a White-Nonwhite split. The interaction with the branching mode seems to be the most consistent correlation for all three experiments (.12, .20, .16). Since these are low and positive they would tend to favor the Negro and Mexican-American classification. The interaction with directive sound seems to be sustained across all three experiments (.14, .16, .21) and although low, the correlations also favor the Nonwhite groups. Some indication of the effectiveness for particular ethnic groups is also indicated by the correlations provided for graphic presentations in Experiment I and II (.14, .16).

3.2.2 Occupation

Significant interactions were found between the occupation variable and the posttest scores. For the males all findings were at the .01 level, whereas for the females one of three comparisons reached this level while two reached the .05 level. The drop in posttest score for boys as parents' occupation level decrease was more pronounced than for the girls.

TABLE 3

CORRELATIONS FOR INTERACTIONS OF POSTTEST, SEX, ETHNIC GROUP, AND OCCUPATION CATEGORY WITH MAJOR STIMULI MODES

			Experiment		
			I	II	III
Posttest X	(Sex)	(Branching)	018	127[b]	-018
	(Sex)	(Verbal)	-055	-053	131[b]
	(Sex)	(Graphic)	030	064	-065
	(Sex)	(Directive)	046	081	023
	(Sex)	(Redundant)	-023	001	-031
Posttest X	(Ethnic)	(Branching)	122[b]	202[a]	166[a]
	(Ethnic)	(Verbal)	065	-046	184[a]
	(Ethnic)	(Graphic)	146[b]	160[a]	052
	(Ethnic)	(Directive)	149	162[a]	217[a]
	(Ethnic)	(Redundant)	125[a]	090	-041
Posttest X	(Occupation)	(Branching)	-062	-079	-050
	(Occupation)	(Verbal)	-137[a]	-289[a]	027
	(Occupation)	(Graphic)	-034	-054	-159[a]
	(Occupation)	(Directive)	-078	004	-037
	(Occupation)	(Redundant)	-041	-181[a]	-145[a]

[a] $(p < .01)$

[b] $(p < .05)$

The correlation of occupational grouping with ethnic classification is consistent throughout all three experiments as indicated in Table 2. All correlations are negative and would imply that high occupation grouping is aligned with the Caucasian group. The lower negative correlation would indicate a slight deviation from this pattern. Also of interest, and exhibiting a similar pattern, is the correlation with posttest scores in all three experiments which would indicate that students in the higher occupational groups obtain higher posttest scores. Correlations with total IQ score exhibit a similar pattern and are higher than those obtained for the interaction with total posttest scores.

The interaction of parents' occupational level and the stimuli modes seem to indicate that branching presentations do help the lower occupation group students, but this aid seems slight. The interaction correlations would lend more support to the conclusion that print versions in Experiments I and II enhanced the performance of higher occupation youngsters. The same might be derived from the correlations obtained for redundant sound versions in Experiments II and III.

3.2.3 Sex

Looking across the rows of results forming Table 2, one is alerted at once to the low correlations of sex with the other learner characteristics and the dependent variable. A consistent pattern of higher posttest scores for boys is provided for all three experiments (.05, .02, .007), but the differences are miniscule. The correlations for total IQ (.09, -.05, -.03) would also favor an equal distribution of high and low IQ scores among boys and girls. One exception should be noted, however, in relation to the total F Battery score. In Experiment II girls obtained higher scores on the F Battery and a slight indication (.02 and .07) is also provided for this pattern in Experiments I and III. Earlier appraisals of male/female differences in regard to ethnic and occupation grouping did reflect differences within these categories.

Certain interaction correlations indicated an advantage for girls in Experiment II when using branching treatments (.127), and verbal versions in Experiment III.

3.2.4 F Battery

It will be helpful to briefly review the characteristics of the total F Battery score in relation to the dependent and independent variables already examined prior to proceeding with a perusal of additional data obtained for this measure. This recapitulation will aid in the review of other data.

The total F Battery score was highly related to the score for the dependent variable in all three experiments (.42, .53, .53). The subparts of the

TABLE 4

MEANS, STANDARD DEVIATIONS, F TEST RESULTS, AND VARIATION r'S ON F BATTERY FOR WHITE AND NONWHITE GROUPS

		Experiment I (N = 382)				Experiment II (N = 376)				Experiment III (N = 383)			
		NW	W	F	r	NW	W	F	r	NW	W	F	r
Identical Forms	M	27.28	27.54	.130	.018	25.70	26.91	2.61	.083	26.25	27.49	2.11	.074
	SD	7.73	6.54			7.98	6.31			7.74	7.43		
Sentence Order	M	5.86	7.65	50.59[a]	.342	5.72	8.05	59.29[a]	.369	6.11	7.27	14.35[a]	.190
	SD	2.33	2.59			2.85	2.76			2.63	2.73		
Match Problems	M	12.57	15.60	16.20[a]	.202	11.73	17.68	49.84[a]	.342	15.91	16.25	.141	.019
	SD	7.03	7.70			7.65	7.87			7.23	8.13		
Omlet	M	5.67	6.23	3.94[b]	.101	5.98	6.79	6.06[b]	.126	5.79	6.52	4.89[b]	.112
	SD	2.63	2.90			2.79	3.17			2.83	2.91		
Figural Similarities	M	9.35	9.56	.459	.034	9.19	10.03	6.37[b]	.129	8.99	9.97	6.89[a]	.133
	SD	3.06	3.14			3.13	3.05			3.51	3.16		
Right Order	M	4.22	17.86	65.12[a]	.382	7.13	18.25	25.02[a]	.250	11.32	16.97	4.63[b]	.109
	SD	9.55	21.52			15.37	22.82			21.95	23.59		
Making Objects	M	15.84	19.86	39.64[a]	.306	16.32	19.71	27.67[a]	.262	18.27	20.48	9.17[a]	.153
	SD	6.43	6.01			5.90	5.97			7.07	6.14		
F Battery Total	M	77.23	88.25	34.06[a]	.286	75.23	90.98	61.76[a]	.376	82.60	89.78	9.88[a]	.158
	SD	16.64	20.21			18.15	18.72			19.04	20.50		

[a] $p < .01$

[b] $p < .05$

Battery that demonstrated the greatest relationship to posttest total were sentence order (.49, .55, and .53) and match problems (.43, .43, and .44). The former was primarily a verbal measure requiring the ordering of verbal statements, and the latter a figural adaptive flexibility task. The two subtests which correlated the least with the posttest total were those requiring figural identification and classification of figural classes: identical forms (.19, .14, .21), and figural similarities (.03, .19, .18). The subtests in Experiment I, as a group, exhibited higher correlation as well as a more restricted range of correlations with the dependent variable (.18 to .58).

The question was posed as to which set of the 36 variables accounted for the largest portion of the multiple R. The total IQ score and total F Battery score, by themselves, were not significantly different in accounting for the largest portion of the multiple R from any other combination of 10 or 35 variables. In Experiment II the smallest group of variables, approximating the total R, were IQ scores, F Battery score, sex, directive sound, and verbal treatment in concert.

The overall relationship of ethnic classification to total F Battery was positive. In general, high scores on the measure seemed to be more closely related to students in the Caucasian classification in Experiment I, evenly distributed in Experiment II, and more closely related to the nonwhite classification in Experiment III. When the correlations with IQ were examined, based on inclusion of only nonwhite and white groups in the analysis, the relationship of total F Battery to IQ score increased (.642, .546, .587). An increase in correlation was also observed for the relationship between girls and high F Battery scores in Experiment II. Girls scored higher on the measure than boys. Table 4 shows the white/nonwhite relationships.

3.3 Programing and Stimuli Modes

The results of comparisons of the linear and branching modes revealed different patterns for all three experiments. In all three the score for students completing the branching treatments were higher. An analysis of covariance indicated this was significant, ($<.10$) in Experiment I, ($<.05$) in Experiment II, and N.S.D. in Experiment III.

Comparison of individual posttest means was also done by using Scheffé's test for multiple comparisons (Scheffé, 1953, 1959). The conservative nature of this multiple comparison technique in psychological research, as contrasted to other similar techniques, is discussed at length by Ryan (1959). The analysis of covariance and variance results are presented in Tables 4, 6, 8, and 9, and the Scheffé comparisons in Tables 5, 7, and 10.

3.3.1 Experiment I - Non-Concrete Referent

Overall analysis of posttest results - The analysis of covariance using the posttest score as the dependent variable is reported in Table 5. The selection of the two covariates, total IQ score and total F Battery score, for the three experiments was made following the examination of results obtained from un unrotated and rotated factor analysis procedure. The steps followed in the selection process are outlined in the major report. The comparison of the linear and branching modes was significant at the .10 level. Some indication of a difference in the visual modes (print, graphic, and motion) was obtained at the .25 level. However a .10 level of acceptance had been established as a criterion level for accepting or rejecting hypotheses or accepting the tests of significance as meaningful. When the interaction of the stimuli and programing modes were examined as a source of variation, some interaction between the sound and visual mode was observed ($p < .25$).

The directive sound, when used in concert with the print and graphic materials, was a more effective presentation combination than either the redundant or no sound modes used in conjunction with the print and graphic modes when adjusted mean scores were compared, ($p < .01$, $p < .05$).

In the case of the motion and sound presentations, the pattern deviated from the two other visual-sound mixes. The only comparison reaching a significant level was the directive and no-sound motion presentation and this favored the no-sound treatment ($p < .10$). When the no-sound and directive treatments means had been compared without regard to visual or programing modes, the no-sound treatments were significant ($p < .05$).

3.3.2 Experiment II - Concrete Referent

Overall analysis of posttest results - The results of the analysis of covariance are reported in Table 7. Examination of the adjusted means in the analysis of covariance reported in Table 7 indicated that the variation between the visual modes was significant at the .01 level and the variation between the audio modes was not significant. However, the programing mode did prove to be significant ($p < .05$). When the remainder of the analysis was examined for interactions the relationship between the audio and programing modes obtained a meaningful level of significance ($p < .05$).

When multiple comparisons using the Scheffe test were accomplished, the still graphic and motion presentations were significantly more effective than the printed verbal (visual) presentations ($p < .01$). In addition, the motion picture versions were more effective than the graphic presentations ($p < .10$).

Although not significantly different in the analysis of covariance, the variation between the audio presentations showed a pattern whereby directive sound was most effective when used with print materials ($p < .05$). Significant

TABLE 5

POSTTEST RESULTS: EXPERIMENT I - NON-CONCRETE REFERENT
Analysis of Covariance
(Covariates: IQ and "F" Battery)

Source of Variation	df	Adjusted SS	Adjusted MS	F	Prob.
Programing Modes (L:B)	1	104.647	104.647	2.922	<.10
Visual Modes (P:G:M)	2	105.961	52.981	1.494	<.25
Audio Modes (NS:R:D)	2	21.764	10.882	.293	.....
Visual x Programing	2	11.232	5.616	.158	.....
Audio x Programing	2	43.500	21.750	.599	.....
Audio x Visual	4	215.750	53.944	1.521	<.25
Audio x Visual x Programing	4	106.653	26.663	.751	.....
Within	368	13050.775	35.464		

TABLE 6

NON-CONCRETE REFERENT - COMPARISON OF INDIVIDUAL POSTTEST MEANS USING SCHEFFE'S TEST FOR MULTIPLE COMPARISONS

COMPARISONS	UNADJUSTED		ADJUSTED	
No Sound vs. Directive	21.62	22.62	21.63	22.93**
Print/No Sound vs. Print/Directive	20.74	22.48	20.47	23.39***
Print/Redundant vs. Print/Directive	21.35	22.48	21.10	23.39*
Graphic/N.S. vs. Graphic/Directive	21.17	23.93*	20.95	23.95***
Graphic/Redundant vs. Graphic/Directive	22.60	23.93	21.63	23.95**
Motion/Directive vs. Motion/N.S.	21.58	23.26	21.53	23.62*
N.S./Linear vs. No Sound/Branching	21.48	21.86	20.73	22.39**
Redundant/Linear vs. Red./Branching	21.26	23.29*	21.35	22.48

Scheffé Test * <.10,
** <.05,
*** <.01

TABLE 7

POSTTEST RESULTS: EXPERIMENT II - CONCRETE REFERENT
Analysis of Covariance
(Covariates: IQ and "F" Battery)

Source of Variation	df	Adjusted SS	Adjusted MS	F	Prob.
Programing Modes (L:B)	1	181.344	181.344	4.42	<.05
Visual Modes (P:G:M)	2	1525.301	762.522	18.69	<.01
Audio Modes (NS:R:D)	2	55.115	27.566	.675	.....
Visual x Programing	2	317.941	158.971	3.884	<.05
Audio x Programing	2	10.567	5.284	.117	.....
Audio x Visual	4	154.574	38.644	.941	.....
Audio x Visual x Programing	4	178.024	44.506	1.091	.....
Within	391	15954.816	40.805		

TABLE 8

COMPARISON OF INDIVIDUAL POSTTEST MEANS
USING SCHEFFÉ'S TEST FOR MULTIPLE COMPARISONS

COMPARISONS	UNADJUSTED		ADJUSTED	
Printed Verbal vs. Still Graphic	29.24	32.57***	29.48	32.41***
Printed Verbal vs. Motion Picture	29.24	33.74***	29.48	34.02***
Motion Picture vs. Still Graphic	32.57	33.74	32.41	34.02*
Print/Redundant vs. Print/Directive	27.29	31.02*	28.09	30.80**
(Motion/Dir. &/N.S.) vs. Motion/Red.	33.25	35.59	33.34	35.12*
Motion/Directive vs. Motion/Redundant	33.10	35.59*	33.10	35.12*
Graphic/Linear vs. Graphic/Branching	31.46	33.72*	31.76	33.07**
No Sound/Linear vs. No Sound/Branching	30.78	32.85*	30.67	33.40***
Redundant/Linear vs. Redundant/Branch.	30.69	32.78*	31.32	32.12

Scheffé Test * <.10,
** <.05,
*** <.01

levels were also obtained when sound and motion combinations were examined. Motion in concert with redundant sound was superior to the no sound and directive sound versions at the .10 level.

The branching-linear interaction favored the branching treatment only in the visual presentation of graphic stimuli ($p < .05$). When no sound and redundant sound unadjusted means were examined in relation to the programing modes, branching was more effective for both at the .10 level. When the adjusted means were compared only, the no-sound version obtained a level of significance in favor of branching, and this was at the .01 level.

Whereas in the first experiment a strong indication for a visual source of variation had not been recorded, this experiment indicated that non-verbal treatments (graphic/motion) were significantly better than completely verbal presentations. The brief for a particular brand of sound was less distinct, in fact somewhat garbled, as contrasted to Experiment I wherein directive sound seemed to be more effective.

The indication in Experiment I that the branching mode was more effective than the linear was substantiated more conclusively in Experiment II.

3.3.3 Experiment III - Action-Process

Overall analysis of posttest results - The analysis of variance resulted reported in Table indicate that variation was taking place between the visual modes at the .10 level and between the audio modes at the .05 level. These differences were not sustained in the analysis of covariance.

The comparison of individual unadjusted means reflected a difference between the still graphic and printed verbal presentations in favor of the graphic at the .01 level. Directive and no-sound treatments were more efficient than redundant treatments at the .01 level.

The directive sound maintained a superior level of effectiveness in the graphic/sound ($p < .05$ and $p < .01$) comparisons and also in the print/redundant, print/directive interactions. Again, some indication of the superiority of the branching mode was obtained in the comparison for graphic materials ($p < .10$) and in the redundant sound comparisons ($p < .05$).

TABLE 9

POSTTEST RESULTS: EXPERIMENT III - ACTION PROCESS
Analysis of Covariance
(Covariates: IQ & "F" Battery)

Source of Variation		Adjusted s.s.	Adjusted m.s.	F	Prob.
Programing Modes (L:B)	1	19.778	19.778	.907	.....
Visual Modes (P:G:M)	2	52.427	26.214	1.265	.....
Audio Modes (NS:R:D)	2	22.4344	11.223	.541	.....
Visual x Programing	2	67.944	33.972	1.40	.....
Audio x Programing	2	23.633	11.824	.571	.....
Audio x Visual	4	83.893	20.973	1.013	.....
Audio x Visual x Programing	4	93.217	23.304	1.125	.....
Within	413	8552.428	20.714		

TABLE 10

COMPARISON OF INDIVIDUAL POSTTEST MEANS
USING SCHEFFE'S TEST FOR MULTIPLE COMPARISONS

COMPARISONS	UNADJUSTED	
Printed Verbal vs. Still Graphic	21.07	21.90***
Redundant vs. Directive	20.01	21.90***
Redundant vs. No Sound	20.01	21.34***
Print/Redundant vs. Print/Directive	20.62	22.98**
Graphic/Redundant vs. Graphic/Directive	18.67	21.96***
Graphic/N.S. vs. Graphic/Directive	20.04	21.96*
Graphic/Linear vs. Graphic/Branching	19.40	21.01*
Redundant/Linear vs. Redundant/Branching	19.12	20.97**

Scheffe' Test *<.10,
**<.05,
***<.01

TABLE 11

POSTTEST RESULTS: EXPERIMENT III - ACTION PROCESS

Analysis of Variance

Source of Variation	df	s.s.	m.s.	F	Prob.
Programing Modes (L:E)	1	59.832	59.832	1.52	.....
Visual Modes (P:G:M)	2	196.955	98.478	2.50	<.10
Audio Modes (NS:R:D)	2	264.091	132.054	3.35	<.05
Visual x Programing	2	61.314	30.664	.79	.....
Audio x Programing	2	81.264	40.632	1.03	.....
Audio x Visual	4	171.524	42.881	1.09	.....
Audio x Visual x Programing	4	119.878	29.974	.76	.....
Within	415	16336.452	39.374		

4.0 DISCUSSION

4.1 Discussion of Hypotheses

The following discussion of the research results is undertaken initially in terms of the hypotheses this research was designed to test.

4.1.1 Learner characteristics of IQ, achievement, sex, ethnic group, and parent's occupation do not interact with media stimuli and programing modes to produce significant differences on the dependent variable.

The results of the analysis of variance and the correlational evidence do not support this hypothesis with the exception of the sex characteristic. The high correlation of IQ and achievement scores with the dependent variable, the important role of the IQ score in determining the Multiple R, and the distinctly different levels of performance for high and low IQ students, all indicate the importance of this independent variable. Ethnic classification and grouping based on parent's occupation provided low but significant correlations with the dependent variable. The interactions within each category produced meaningful significances indicating that differences do occur on the dependent variable related to these learner characteristics. When these characteristics were reviewed in light of male and female groupings for ethnic and occupation variables significant differences were obtained throughout all three experiments.

4.1.2 There will be no significant differences in performance by sex on the dependent variable.

The correlations obtained for this comparison were low and indicated a slight advantage for males, but not significant. The hypothesis is therefore accepted.

4.1.3 Students who obtained high scores after viewing graphic and motion versions also will have significantly higher scores on the F Battery.

A slight indication of this relationship was provided in two experiments (I and II) although no significant relationships were found. That this pattern evolved is not surprising since the correlation of total IQ score with the verbal versus nonverbal (graphic and motion) dichotomy is equally small, but favors prediction of performance on verbal treatments in two experiments instead. The exception was Experiment II, where knowing total IQ score and whether the student had received a nonverbal treatment also helped predict the posttest score; as had been the case with the F Battery. The large and significant F values obtained are more a reflection of the large n's and the value of the F Battery for predicting the score for the dependent variable than providing a discriminator for verbal or nonverbal treatments. Addition of the IQ score to the F Battery score improves the predictive ability.

4.1.4 Scores on the F Battery will not be highly correlated with ethnic and occupational groupings.

The evidence provided by the correlations does not support this hypothesis. The F Battery was moderately correlated with these variables and levels of significance were obtained. The general pattern indicated students who had parents in high occupational groupings also tended to receive high scores on the F Battery in two of the three experiments. The pattern was less pronounced for the ethnic experiments but high scores on the F Battery tended to be aligned with Caucasian and Oriental-American youngsters.

4.1.5 Variation within the Non-white category as to performance on the dependent variable will be as great as the difference between the White and Non-white ethnic classifications.

No evidence was obtained to support this hypothesis. In fact, the highest level of variation obtained was 11 percent between any of the three comparisons based on the ethnic factor. Consequently, one must suspect that a very large portion of the difference in scores on the dependent variable was due to factors other than ethnic classification.

4.1.6 The most effective combination of presentation modes for low IQ, Non-white, low occupation students will be graphic-motion/sound/branching treatments.

Some limited evidence to support this hypothesis was found. In particular, the hypothesis was supported by a significance level in Experiment II but here the no-sound presentation was present. Low but non-significant correlations were obtained for Experiments I and III. Interestingly enough, a parallel pattern was obtained for the total population with the nonverbal/no sound/ branching combinations also being significant in Experiment II.

4.2 Patterns Relating to Each Learner Characteristic

4.2.1 IQ

The importance of the total IQ score in predicting posttest performance in all three experiments is considerable. The portion of the Multiple R that could be accounted for by the total IQ score was impressive. The high correlation of this variable with the achievement measures would seem to imply that "school ability" played a major part in posttest performance. One might ask what additional component was added by the F Battery total that enable the total IQ and F Battery score to combine in two of the three experiments, to provide the pair of predictors that could approximate the total R, and also be clearly identified as a principal covariate for the analysis of covariance following the factor analysis? Some evidence may be provided by the two components of the battery, identical forms and figural similarities, that have low or

negative correlations with IQ yet maintained low correlations with the total posttest score. These differences may have provided enough variance between the two measures that when paired potential prediction of the dependent variable was improved.

The relationship of IQ to the other learner characteristics of occupational grouping and ethnic classification extended from moderate to high correlations. The minimal difference between boys and girls on the IQ variable was cited earlier.

When the question of differences obtained on the dependent variable within two groups identified as low IQ and high IQ, a pattern emerged whereby the former performed better after motion/directive/branching treatments, whereas the high IQ group evidently benefited significantly from graphic/no sound/branching presentations.

4.2.2 Ethnic

In general, not only were significant differences obtained when comparisons were made between ethnic groups on the dependent variable, but comparisons between classifications by male and female groupings were also meaningful. The scores obtained by Oriental-American students were equal to or exceeded the students in the Caucasian grouping. However, it must be kept in mind that fewer Oriental students than Caucasian were involved in the study. This is also true when any assessment of scores of Negro or Mexican-American students are observed, especially when comparisons are made for any of the 18 treatments in one experiment. The establishment of White and Non-white groups provided a method for combining n's involved with all combinations of treatments. These comparisons provided significant indications that Non-white students gained instructional advantages when branching and directive sound treatments were utilized and to some extent from graphic treatments as well; although not always to the exclusion of the White children who also recorded higher scores following these combinations of instruction.

An interesting facet of the comparison of the two major ethnic groups is the overlap of scores on both posttest and F Battery. When the distributions for both are plotted sizeable overlap is evident in spite of the larger number of Non-white students with low scores and more White students with high scores. The comparability of scores in all three experiments is well over 50 percent.

However, when an attempt was made to identify subparts of both of the measures which could be identified as "less anxious" items for the Non-white group, only the identical forms, match problems, and figural similarities on the F Battery appeared to meet the established criteria. All other parts recorded significant levels which indicated substantial differences between performance by ethnic classification on the subparts of both measures. Match problems was correlated significantly with both ethnic and occupation variables ($p < .01$), the other two were not.

4.2.3 Occupation

The results provide added evidence, if any is needed, that differences in parent's occupational level influence performance on the dependent variable. The general performance pattern indicated that children from the professional and managerial classifications received the higher scores, and children from the semi-skilled or unskilled groupings obtained the lowest scores on the dependent variable. On one occasion students in the clerical group did obtain higher scores than children from managerial families. The semi-skilled category in two instances recorded scores higher, but not significantly different, than the skilled group. The correlations of occupation and ethnic classifications ranged from high to moderate; in one experiment the White ethnic classification was highly correlated with high occupation, whereas in two experiments this relationship was less pronounced.

The male population followed the overall trend from high to low, however, for the females the slope of the line was less pronounced. Also, another indication of these differences is reflected by the lower levels of significance obtained when comparisons were made between the girls.

Some evidence is provided to support the notion that students in lower occupational groups are aided by branching presentations. Although these correlations are low and not significant for the total population, they increase in magnitude when the exceptional group, comprising Non-white, low IQ, and low occupation categories is considered separately. Although verbal treatment correlations are significant in two experiments for the total population, the pattern is reversed for the exceptional group, and reaches a level of significance in Experiment II where primarily graphic content was being taught.

The graphic treatment did help the total population when viewing the action-process materials in the third experiment, but played to a disadvantage for the exceptional children. The redundant sound treatment was significantly correlated with occupational level in two of the three experiments, and for the exceptional group redundant sound helped in Experiment II and III and directive sound in Experiment III.

The F Battery as a measure provided additional predictive value for determining the dependent variable. The subtests of sentence order and match problems provided the highest correlations with total IQ score and the dependent variable. Unique qualities of the measures were provided by the identical forms and figural similarities subparts.

The area of overlap in the frequency polygons between White and Non-white groups appears to be larger than those obtained for IQ. The F Battery maintained a consistent positive relationship with directive sound treatments across all three experiments, a negative relationship to redundant sound and graphic presentation scores, and yet retained a positive correlation with the

nonverbal treatment groups (graphic and motion). It provided little indication of whether it was identified with the branching or linear treatments. It departed very little from the pattern of relationship exhibited by the total IQ score to the presentation modes. This is understandable in light of their high correlation. When paired, the two provide a better predictor of performance on the dependent variable than either one alone.

Most interesting is the similarity in scores between the identical forms, figural similarities, and match problems for both White and Non-white groups, thus hinting that these are possible "less anxious" subtests. Differences in F Battery scores by occupational level do not follow the posttest pattern as closely but the overall pattern seems to indicate that high F Battery scores go with high occupational classification.

5.0 CONCLUSIONS

5.1 For This Study

Results for the students involved support the conclusions that:

1. Learner characteristics do interact with media and programing modes to affect scores on the dependent variable.

    a. Total IQ score seems to provide the best indicator.

    b. When the F Battery total score is combined with the total IQ score, predictive ability is improved in relation to the instruction and criterion measure provided in this study.

    c. A learner's ethnic classification has a meaningful relationship with the media and programing variables, although it only accounts for a small portion of the variance affecting the posttest score.

    d. The occupation of a student's parent does bear a direct relationship to the posttest score. Higher scores are related to higher occupational classifications.

    e. Girls and boys do equally well on the dependent variable.

    f. Differences are obtained, however, within male and female groupings for ethnic and occupational designations.

    g. Comparison of adjusted means between male and female, ethnic and occupational designations, indicate that no meaningful differences occur.

2. Subtests of the F Battery provide items which tend to minimize the variations obtained when ethnic classifications are compared.

3. Exceptional children, identified as having low IQ, Non-white, and representing the three lowest occupational groups, obtained higher scores after receiving the nonverbal, sound, branching treatments provided in this study.

4. Some indications were obtained that children in the exceptional category perform better on all branching treatments.

5.2 The Findings as They Pertain to Earlier Research

A comparison of this study's findings of the relation of learner characteristics as they react with media stimuli and programing modes, and earlier research will indicate areas of agreement or variance.

Verbal ability as measured by the total IQ test seemed to provide the best indicator of performance regardless of the manner of instruction received. However, low IQ students did score higher on the graphic and motion treatments in two of the three experiments. The third did not provide noticeable differences. These findings would tend to support the research of Gibson (1962), Vernon (1946), and Gropper (1965), who indicated that these students score higher on criterion measures after seeing pictorial as contrasted to non-pictorial presentations.

The general pattern provided for total IQ as it related to the visual presentation modes indicated an extremely low but positive correlation with verbal treatments, and a low but negative correlation with graphic modes. This finding, plus the fact that the F Battery provided slightly reversed correlations in two of the studies, would tend to support the findings of Dawson (1964), and Gagné and Gropper (1965).

The entire low IQ group and exceptional student group appeared to benefit least from verbal treatments in two of the experiments. In the third the pattern was reversed, but this may have been directly related to the poor quality of the visual material presented in the graphic treatments. Whereas this pattern did not occur for the total population in relation to IQ score, one might suspect that the substandard visuals in the one study provided less of a distraction for the high IQ youngsters.

For the total population, IQ was positively related to utilization of directive sound and demonstrated a negative correlation for redundant sound. This finding would agree with Hartman (1961), who indicated that the audio channel is a more efficient communicator when the subjects are illiterate. Granted that these subjects were not in this category, yet the degree of reading proficiency is related to the IQ score and may possibly be indirectly assessed through this measure. When the exceptional group is examined separately we find a pattern favoring the use of redundant sound in two of the three experiments; in the third it is demonstrated that there is more efficient teaching via directive sound.

The performance of the exceptional students and low IQ categories maintained a similar pattern in relation to the programing modes. Both groups obtained positive but low correlations with branching presentations, whereas total IQ scores for the total population did not correlate with the programing modes. These results would tend to differ from the earlier research findings of Silberman et al. (1961), and also related to Campbell's work (1962), which

indicated more efficient learning when bypass branching sequences are utilized for all students, but less so for students of lower grades.

Support for branching as the more efficient mode in these two below-average subgroups is confounded to some degree when the overall ethnic comparisons are examined. Students in the White classifications scored higher on the posttest after completing branching treatments. However, there is little indication to support any real difference due to occupational grouping when performance on linear or branching treatments are examined. A comparable pattern is obtained for sex in two of the three experiments, whereas one, the concrete referent study, girls performed significantly better after using branching programs.

An examination of the results of this research pertaining to ethnic and occupational differences would tend to support previous conclusions discussed in the research literature. The score obtained for ethnic and occupational grouping, and the correlations of each with total IQ score would lend support to the findings of Deutsch and Brown (1964), wherein they indicated the lower ethnic and occupational categories had lower IQs. Support for the correlation of high scores and upper occupational group is provided by McCord and Demerath (1958). Their results were comparable. The statistical relationship exists as they indicate but the complicated causal web is difficult to disentangle. Does the student's home environment, conditioned by the "milieu" created due to the parent's occupation, bring about cognitive and affective advantages or disadvantages that are reflected in the test scores?

The interesting aspect of their study is that the population included both White and Non-white boys distributed throughout the occupational groupings. Since their study drew upon urban Northern boys this might indicate why such a distribution was available. The socio-economic differences among Non-white races as reported by Schmid and Nobbe (1965), reflect higher income, level of education and occupational grouping for Japanese, Chinese, and White ethnic groups, as contrasted to Negro. Hence, the increased complexity of interpreting the causal web when ethnic classification is evaluated in concert with occupational grouping. When the White/Non-white comparison was examined by Edmonds (1962), it was shown that greater differences are found within the ethnic grouping itself than between groups. This conclusion is amply substantiated by the findings of this study.

The pattern obtained herein for the Mexican-American youngsters also supports the related research in that these youngsters did obtain lower scores than either Oriental-American or Anglo-American children (Carlson & Henderson, 1950; Cook & Arthur, 1955). In certain experiments the Mexican-American youngster obtained higher scores on the dependent variable than the Negro child; in certain other experiments the patterns were reversed. The scores obtained by the Oriental-American youngsters were in keeping with the findings of Bell (1935), Dumas (1945), and Kitano (1962), in that they equalled or

exceeded Caucasian children on a number of comparisons.

The observations of student performance on the F Battery subparts provided some indication of "less anxious" items in regard to ethnic and social classification. Comparable findings by Lesser, Fifer, and Clark (1964), have been obtained which indicate that social class seemed to influence the level of performance while cultural identity affected the pattern of scores. Support for this finding, specifically in relation to the subparts of the posttest and the F Battery comparisons of part scores would lend additional credence to these prior findings.

The article, "Guidelines for Testing Minority Group Children" (Fishman et al., 1964), suggests that the spread of scores for children from lower socioeconomic levels is generally small and thus affects the reliability of their scores. However, the frequency polygons for the Non-white groups on the posttest and F Battery display considerable spread and would tend to indicate that both are reliable measures.

The exploration of items in this experiment identified as "less anxious" is related to the caveat posed by Fishman when he states that high anxiety in testing situations may affect the validity of a measure. The data reported would suggest that anxiety levels may have affected performance on certain items while not on others. The possibility that the "less anxious" items were not related to the criterion or IQ measures must be discarded since all were correlated at a low or moderate level. The attempt to identify conclusively low anxiety producing items on the posttest was not successful. It had been anticipated that the "non-school" aspect of the teaching machine (Finn, 1960, 1963, alludes to this potential use of the teaching machine), the inclusion of items requiring screen presentation, graphic as well as verbal test booklet items, might provide a break from traditional school test patterns and test items and thus lower anxiety and increase motivation.

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